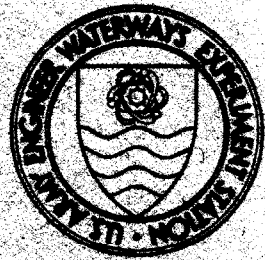


# DREDGED MATERIAL RESEARCH PROGRAM



TECHNICAL REPORT D-78-25

## HABITAT DEVELOPMENT FIELD INVESTIGATIONS NOTT ISLAND UPLAND HABITAT DEVELOPMENT SITE CONNECTICUT RIVER, CONNECTICUT

### SUMMARY REPORT

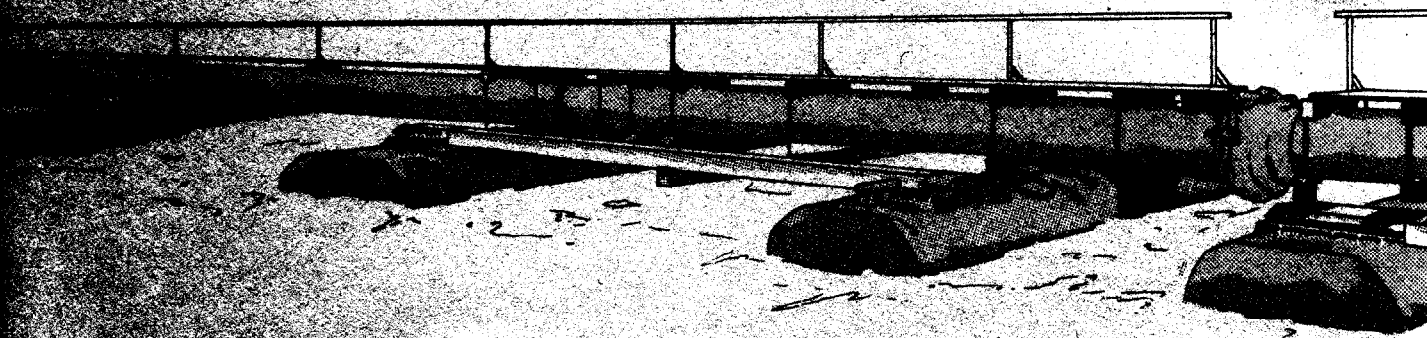
by

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Environmental Laboratory  
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P. O. Box 631, Vicksburg, Miss. 39180

August 1978  
Final Report

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Prepared for Office, Chief of Engineers, U. S. Army  
Washington, D. C. 20314

Under DMRP Work Unit No. 4B04G

**HABITAT DEVELOPMENT FIELD INVESTIGATIONS,  
NOTT ISLAND UPLAND HABITAT DEVELOPMENT SITE,  
CONNECTICUT RIVER, CONNECTICUT**

- APPENDIX A: PRELIMINARY TERRESTRIAL ECOLOGICAL SURVEY**
- APPENDIX B: SURVEY OF TERRESTRIAL ECOLOGY AND PRELIMINARY  
BOTANICAL MONITORING**
- APPENDIX C: POSTPROPAGATION MONITORING OF VEGETATION AND  
WILDLIFE**

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IN REPLY REFER TO:

WESEV

30 September 1978

SUBJECT: Transmittal of Technical Report D-78-25

TO: All Report Recipients

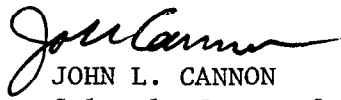
1. The technical report transmitted herewith represents the results of one of a series of research efforts (work units) undertaken as part of Task 4B (Terrestrial Habitat Development) of the Corps of Engineers' Dredged Material Research Program (DMRP). Task 4B was part of the Habitat Development Project (HDP) of the DMRP and had as its objective the development and application of habitat management methodologies on upland disposal areas for the purpose of planned habitat creation, reclamation, and mitigation.
2. Upland habitat development using dredged material was investigated by the HDP under both laboratory and field conditions. This report, "Habitat Development Field Investigations, Nott Island Upland Habitat Development Site, Connecticut River, Connecticut; Summary Report" (Work Unit 4B04G), summarizes the activities that occurred during upland habitat development studies at Nott Island between 1974 and 1977. A general discussion of the engineering and biological aspects of the research is presented. The reader is referred to Appendices A through C to this report for more detailed discussions.
3. A total of three upland habitat development sites were constructed by the HDP at various locations throughout the United States. Those, in addition to Nott Island, included: Bolivar Peninsula, Galveston Bay, Texas (4A13) and Miller Sands, Columbia River, Oregon (4B05). Other work units of the DMRP directly relevant to terrestrial habitat development relate to upland succession (5B03) and island habitat development (Task 4F).
4. Evaluated together, the terrestrial habitat field demonstrations and related succession and insular studies establish and define the conditions under which upland habitat development is feasible. Data presented

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in these research reports will be synthesized in the Technical Reports DS-78-15 and DS-78-17, entitled "Upland and Wetland Habitat Development with Dredged Material: Ecological Considerations" and "Upland Habitat Development with Dredged Material: Engineering and Plant Propagation," respectively.

A handwritten signature in cursive script, appearing to read "John L. Cannon".

JOHN L. CANNON  
Colonel, Corps of Engineers  
Commander and Director

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Connecticut River                      Habitats Dredged material                      Nott Island, Conn. Dredged material disposal              Vegetation establishment Field investigations                      Waste disposal sites Habitat Development                      Wildlife habitats		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  Dredged material from the Connecticut River was placed in an upland dis- posal site on Nott Island, 10 km upriver from Long Island Sound, in 1975-1976. The sediments were fertilized and experimentally limed and planted with legumes and grasses in late summer 1976. Botanical and soil measurements were taken through 1977 to monitor success of vegetation establishment and evolution of soil conditions. Wildlife use of the site was documented and compared with  (Continued)		

## 20. ABSTRACT (continued).

baseline data. This report summarizes habitat development activities at Nott Island, including aspects of engineering, botany, soils, and wildlife.

Dredging and disposal operations were typical of maintenance projects in the area, with the exception that much of the activity had to be done in winter when weather conditions hindered the work. The sediments made a rather harsh environment for establishment of some domestic plant species; soil salinity was high and acidity low. Grasses established and grew better than legumes and achieved 80 percent cover. Wildlife response to vegetation establishment was evident primarily through feeding activity.

## PREFACE

This report summarizes activities at the Nott Island Upland Habitat Development Site in the Connecticut River near Essex, Connecticut. Research was conducted under Task 4B of the Habitat Development Project (HDP) in the Dredged Material Research Program (DMRP), which was the responsibility of the Environmental Laboratory (EL) of the Waterways Experiment Station (WES), Vicksburg, Mississippi. Task 4B had as its objective the development and application of habitat management methods to upland dredged material disposal areas. In addition to 4B, there were four other research tasks within the HDP:

2A Effects of Marsh and Terrestrial Disposal

4A Marsh Development

4B Terrestrial Habitat Development

4E Aquatic Habitat Development

4F Island Habitat Development

Results of additional research of the HDP are available in other reports.

Research contracts for this project were administered by the U. S. Army Engineer Division, New England, which was also responsible for engineering support and dredging and disposal operations. The Connecticut Department of Environmental Protection was responsible for permission to work on State property and for site preparation and planting activities. Contract research was conducted in 1975 by the University of Connecticut and Connecticut College and in 1976 and 1977 by Connecticut College.

A number of individuals cooperated in making this study successful, including especially:

Dr. Bill Barry	Connecticut College, New London
Dr. Bill Niering	
Dr. Scott Warren	

Mr. Ted Bampton	Connecticut Department of Environmental
Mr. Dennis DeCarli	Protection, Hartford
Mr. Tim Linkala	
Mr. Jim Murphy	

Dr. David Hill	The Connecticut Agricultural Experiment
	Station, New Haven

Dr. Walt Washko	University of Connecticut, Storrs
Mr. Cliff Adams	U. S. Army Engineer Division, New England,
Mr. Vyto Andreliunas	Waltham, Massachusetts
Mr. Frank Ciccone	
Mr. Fran Donovan	
Mr. Bob Scheirer	U. S. Fish and Wildlife Service, Concord, New Hampshire

This summary report was prepared and edited by Ms. L. Jean Hunt (EL), with Dr. B. R. Wells (University of Arkansas Rice Experiment Station, Stuttgart) contributing the soils and botany section and Mr. A. W. Ford (EL) the engineering section. General supervision was provided by Dr. Hanley K. Smith, Manager, HDP; Dr. Roger Saucier, Special Assistant for the DMRP; and Dr. John Harrison, Chief of EL. Directors of WES during this study were COL G. H. Hilt, CE, and COL J. L. Cannon, CE. Technical Director was Mr. F. R. Brown.



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NOTE: Appendix C to this report was published separately (see list of appendices on inside of front cover). Appendices A and B were reproduced on microfiche and are enclosed in an envelope attached inside the back cover of this report.

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HABITAT DEVELOPMENT FIELD INVESTIGATIONS,  
NOTT ISLAND UPLAND HABITAT DEVELOPMENT SITE,  
CONNECTICUT RIVER, CONNECTICUT

SUMMARY REPORT

PART I: INTRODUCTION

1. The Dredged Material Research Program, initiated in 1973 to provide information on the environmental impact of dredging activities and alternative means of dredged material disposal, has conducted field studies to test the concept of using dredged material as a substrate for development of aquatic, wetland, and upland habitat. One of eleven such studies was the Nott Island Upland Habitat Development Site, located in the Connecticut River. This site was selected because:

- a. It represented a common potential upland habitat development situation.
- b. The time frame for maintenance dredging of the Connecticut River navigation channel coincided with scheduling constraints of the Dredged Material Research Program.
- c. Active cooperation of the land owner was forthcoming.

2. In early 1975, a 3.2-ha portion of the northern half of Nott Island was enclosed by a sand fill dike. Material dredged during maintenance of the navigation channel and a secondary channel was placed inside the containment area. Soil was treated to reduce anticipated adverse conditions for plant establishment. Planting experiments designed to test the growth of plant species beneficial to wildlife were begun in the fall of 1976 and monitored through the 1977 growing season. This report summarizes the habitat development activities.

## PART II: SITE DESCRIPTION

### The Region

3. The Connecticut River drains a 29,137-km<sup>2</sup> watershed, 3719 km<sup>2</sup> of it in Connecticut, and flows into Long Island Sound. Nott Island is located in the Connecticut River in New London County, Connecticut, between 9.3 and 11.1 km upriver from the Sound (Figure 1). The site is in the Eastern Coastal ecoregion of the Coastal Hardwoods defined by Dowhan and Craig (1976). The region is "characterized by coastlands, including extensive tidal marshes, estuary areas, and sand beaches, by relatively level but rolling nearshore lands, and by protrusions of rugged and rocky upland extending to the coastline." Dowhan and Craig (1976) reported elevations in the ecoregion from sea level to 90-120 m, with greatest relief on the coast and in river valleys.

4. The regional forest vegetation is oak (Quercus spp.), hickory (Carya spp.), black cherry (Prunus serotina), and sassafras (Sassafras albidum). Vines and shrubs are common, and red cedar (Juniperus virginiana) is a dominant of old-field successional stages. Waterfowl of the Atlantic flyway use the Connecticut coast extensively - it is an area of maximum goose and duck migration corridor populations (Bellrose 1976).

5. The influence of Long Island Sound is evident in air temperatures of the region. Average annual and winter temperatures of 10.5<sup>o</sup> C and 0.3<sup>o</sup> C are the highest in Connecticut. Average summer temperature is 21.1<sup>o</sup> C. Mean maximum and minimum temperatures are 27.2<sup>o</sup> C and -5.0<sup>o</sup> C. Average annual precipitation is 116.8 cm, and average seasonal snowfall is 88.9 cm. There are 195 frost-free days, the longest growing season in the state (Dowhan and Craig 1976). The Connecticut coast is subject to storms, with winds averaging 12 km/hr in the summer and fall and 15 km/hr in the winter and spring (Brumbach 1965).

6. A characteristic of the lower Connecticut River is its high variability over time (written communication, Dr. Frank Bohlen, Marine Sciences Institute, University of Connecticut, Groton). Maximum stream-

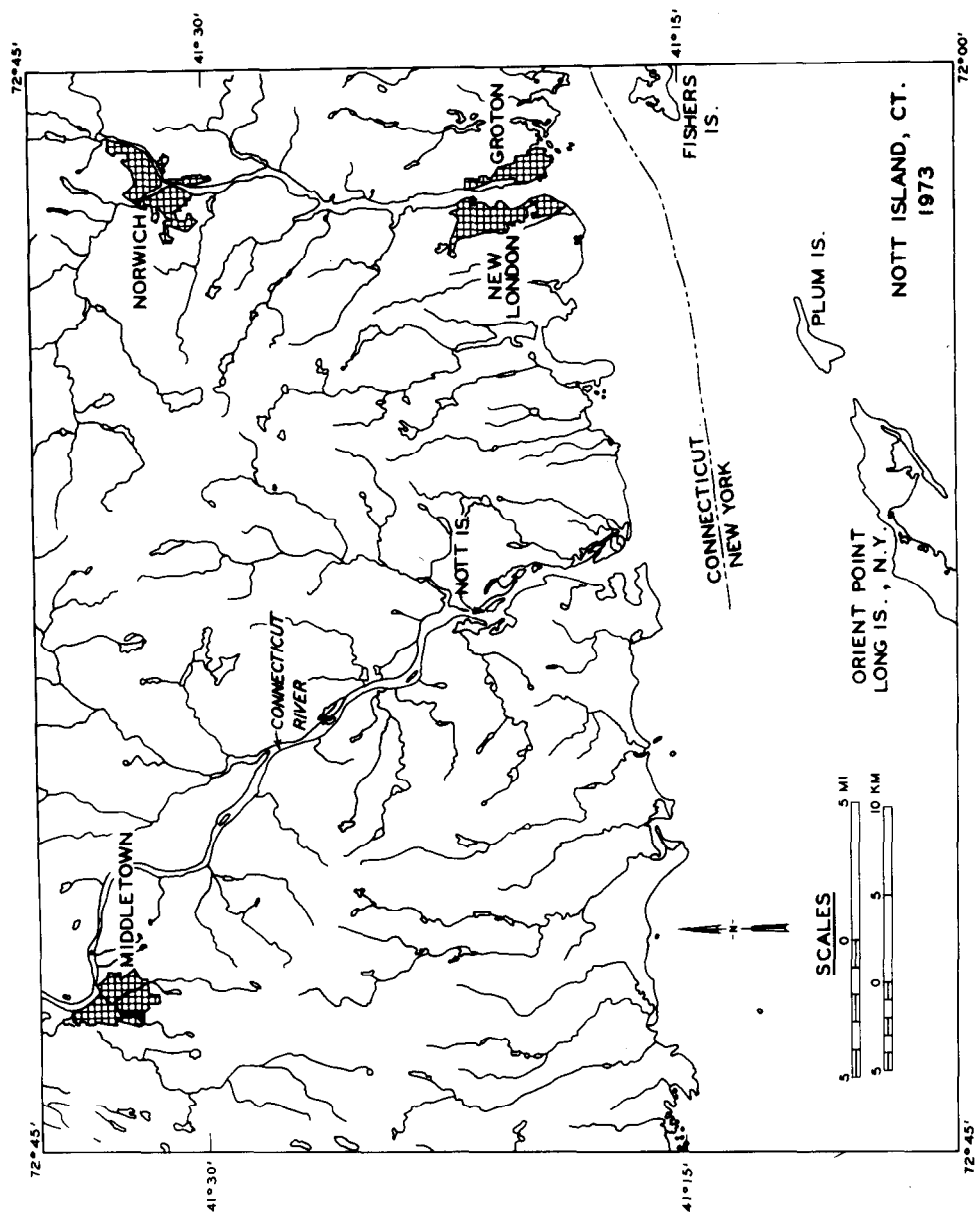


Figure 1. Location of Nott Island in the region.

flow occurs in March and April and minimum in August and September. Average tidal range is 0.75 m, and tidal effects may be observed 96 km upriver. Saltwater intrusion is found commonly up to 13 km and in periods of low flow up to 24 km from the Sound. Maximum water temperatures occur in August and September and minimum in January and February.

7. Industry and farming are the main land uses along the river. The navigation channel serves several industrial centers and 60 commercial and recreational centers between Long Island Sound and Hartford. Products transported include coal, oil, and farm products.

8. There are several shoals in the river that require maintenance dredging; responsibility is with the U. S. Army Engineer Division, New England, in Waltham, Massachusetts. Approximately  $76,400 \text{ m}^3$  of sediments are removed annually; disposal is primarily upland. The navigation channel, a secondary channel, and two anchorages compose this portion of the Connecticut River dredging project, most recently authorized in 1961 (Section 107 of the 1960 River and Harbor Act). The navigation channel is maintained at 4.5 m below mean low water, 45 m wide, and 1050 m long. The secondary channel is 3.0 m below mean low water, 30 m wide, and 1320 m long. Sediments are predominantly sand in the former and sandy silt in the latter.

### The Site

9. Nott Island (Figure 2) was privately owned and farmed from the late 1800's and probably before. It was last grazed in 1948, and the northern half of the island burned in 1960. It has been owned by the State of Connecticut since 1968, and is used for recreation by boaters, picnickers, and hunters. The island is an historical disposal site for sediments dredged from the navigation channel 330 m to the west (Figure 3), with deposition occurring first in 1936 and nine times since then.

10. The island formed naturally by periodic flooding and alluvial deposition, and is composed of peat, loam, and sandy soils (Figure 4).

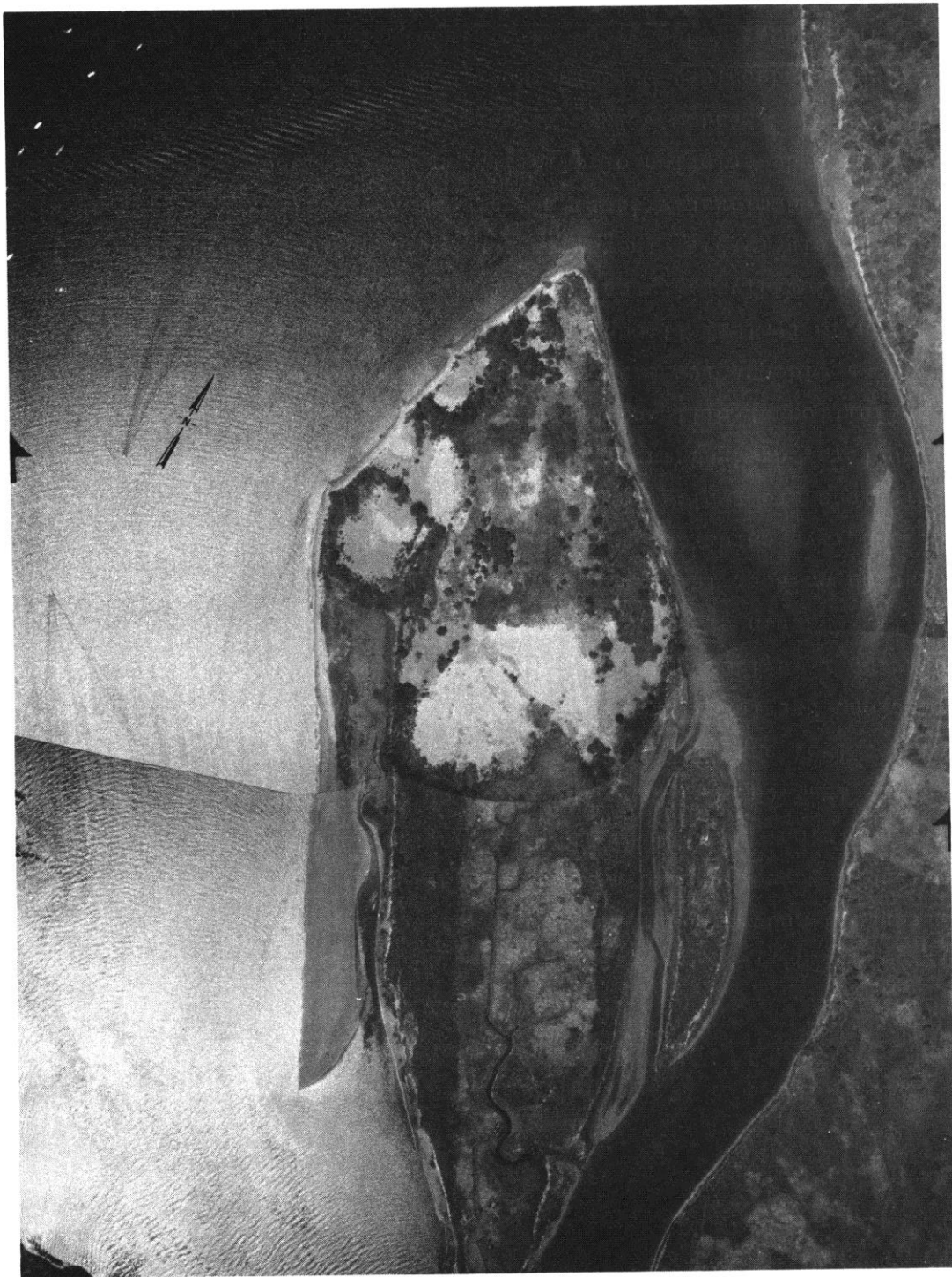


Figure 2. Aerial photograph of Nott Island in June 1974.

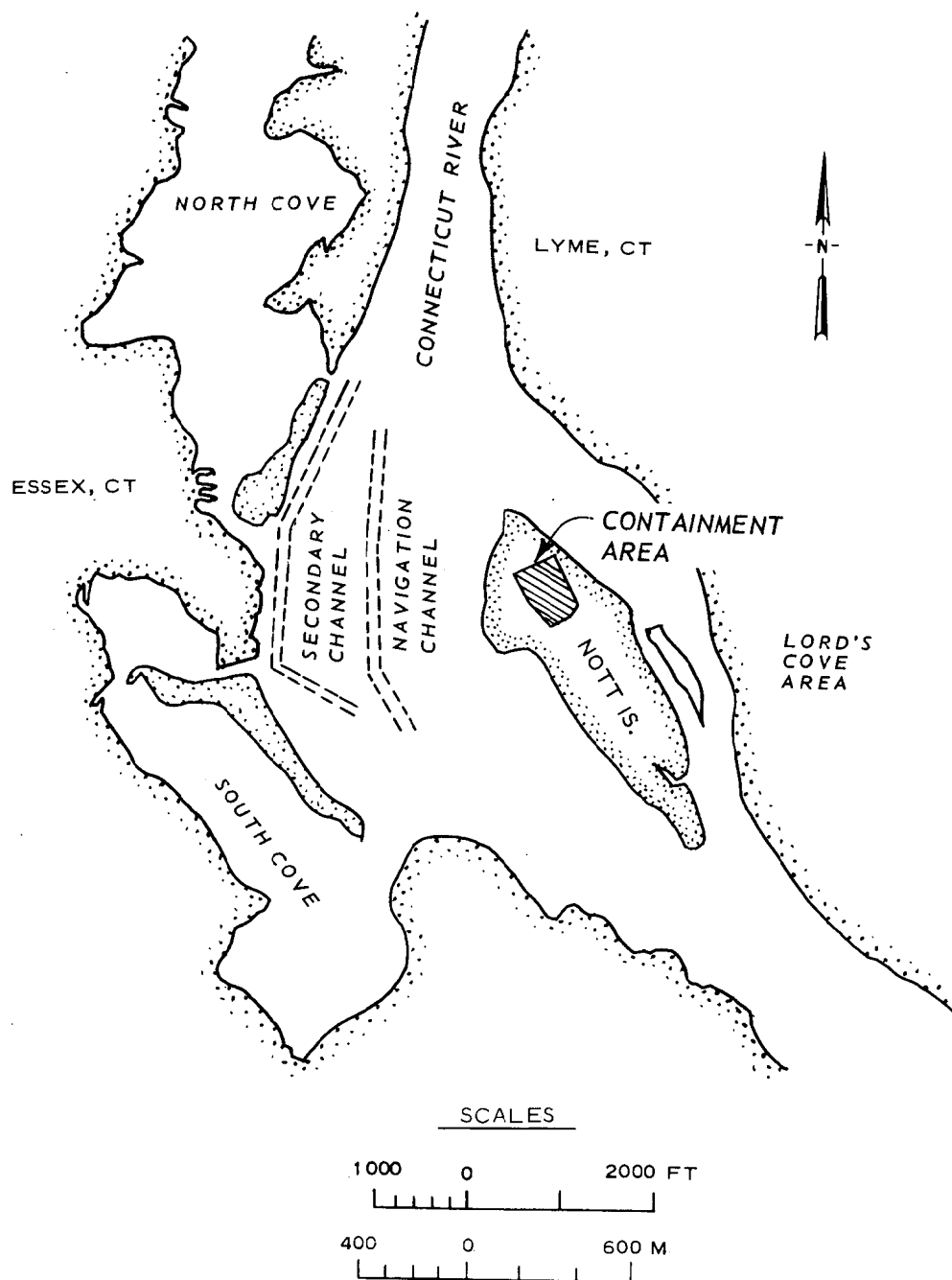


Figure 3. Location of dredging project and containment area for habitat development.



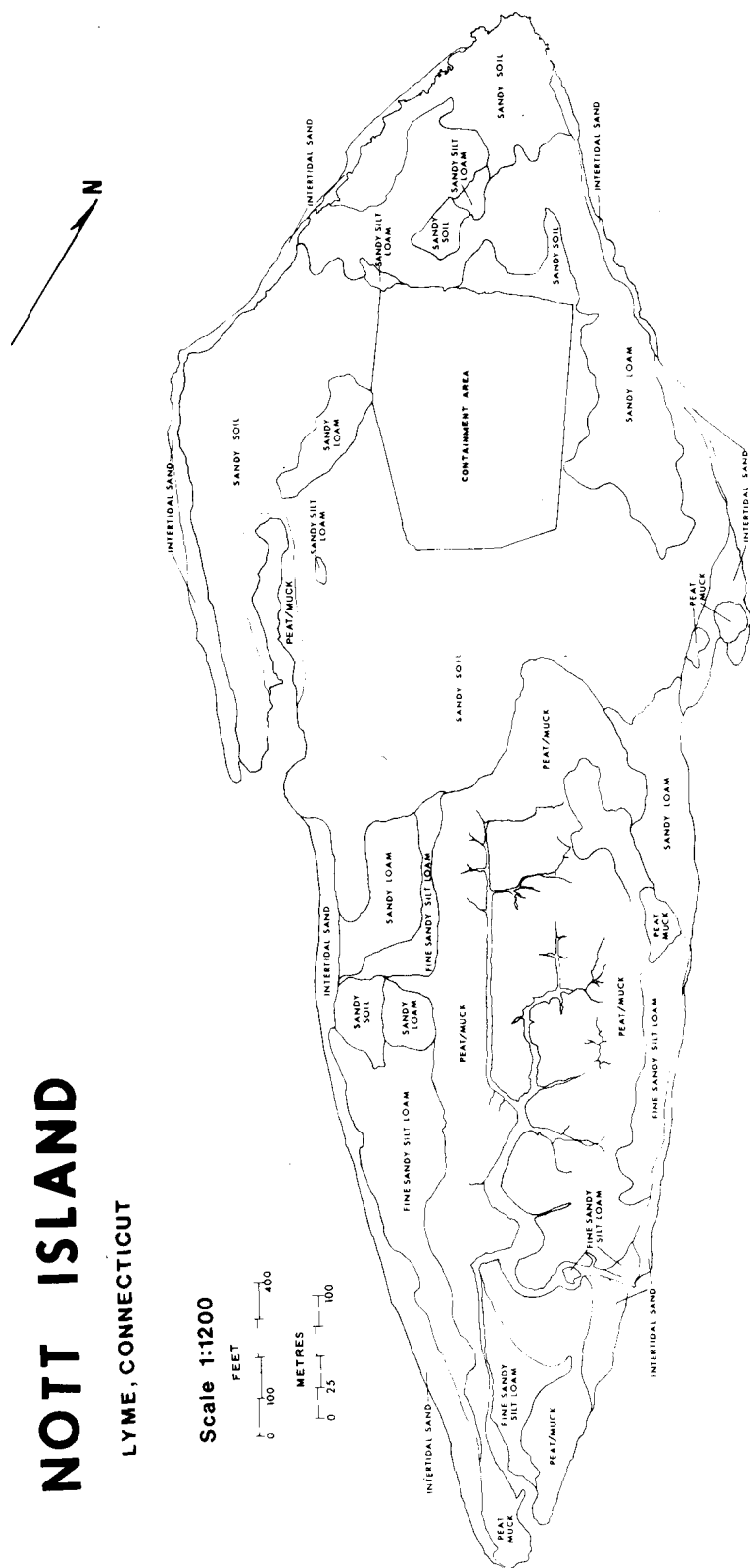


Figure 4. Diagram of Nott Island showing distribution of surface soil types.

Addition of sandy dredged material has increased the relief; a 1974 topographic survey showed maximum elevation of 5 m at the site of a 1964 deposition. Now 31 ha in size, Nott Island has widened appreciably since 1947 through land accretion on the northern end. Maps prepared for 1937 and 1917 by Mr. Jim Murphy (Department of Environmental Protection, Hartford) show almost no change, but some widening and elongation is evident between 1937 and 1947.

11. Warren et al. (1978) provided a thorough description of the vegetation on Nott Island. They identified four shrubland, four grassland, and five estuarine marsh associations (Figure 5). The upland associations are typical of an alluvial site that has been disturbed (agriculture, dredged material disposal); the estuarine marsh follows the definition of Hill and Shearin (1970). A shallow channel to the east, 75 m wide at its minimum, separates Nott Island from the Lord's Cove area, a typical floodplain tree-shrub association, bordered on the north by a low diversity cattail (Typha angustifolia) marsh 165.5 ha in size (Craig 1975). There are two small islands south of Nott Island, which are predominantly cattail and common reed (Phragmites australis).

12. A description of wildlife on Nott Island is found in Warren et al. (1978). Meadow voles (Microtus pennsylvanicus) and meadow jumping mice (Zapus hudsonius) were the most common mammal species recorded. White-tailed deer (Odocoileus virginiana) visited the island frequently. A high density of breeding bird species has been observed.

13. A previous disposal site on the northern half of Nott Island was selected for habitat development (Figure 5). The area was partially vegetated sand, with slightly rolling topography ranging from 1.2 m to 3.3 m above mean low water. Existing vegetation was dominated by switch grass (Panicum virgatum), which covered 60 to 70 percent of the site. False indigo (Amorpha fruticosa) covered 10 to 20 percent. A further description is found in Warren and Niering (1978).

14. As part of the baseline inventory, benthic abundance and distribution data in the channel east of Nott Island that was to receive effluent from the containment area were collected to allow determination of impact. Sediments were found to be of well-sorted, very



Figure 5. Diagram of Nott Island showing pattern of vegetation (after Connecticut College Department of Botany).

fine to medium sand on the Wentworth scale. Benthos was uniform over the area, with freshwater and brackish types present and insect larvae dominant (written communication, Dr. Barbara Welsh, Marine Sciences Institute, University of Connecticut, Groton).

## PART III: ENGINEERING AND CONSTRUCTION

### Methods

#### Preliminaries

15. Hydrographic surveys of the navigation and secondary channels were taken in October and November 1973 by the New England Division to determine the volume of material to be dredged. In November 1974, 13 cores 0 to 1.5 m deep in the navigation channel and 5 cores 0 to 0.6 m deep in the secondary channel were taken and analyzed for particle size. A topographic survey of the proposed containment area in November 1974 established the perimeter and dike crest elevation.

#### Design

16. The hydrographic surveys in 1973 indicated 17,570 m<sup>3</sup> of sediments to be dredged from the navigation channel and 9,930 m<sup>3</sup> from the secondary channel. The containment area was designed from this volume and the topographic survey to be 3.2 ha in size. The containment dike was to be constructed from sand already on the site to an elevation of 3.3 m above mean low water. Planned final dredged material surface elevation was to be 2.7 m above mean low water and the dike was to be graded level with the surface after disposal.

17. Sediment samples from the navigation channel consisted of fine to medium gray-brown sand (SP) according to the Unified Soil Classification System. Fine sandy silts (MH) to silty fine sands (ML) were found in the secondary channel. It was decided to dredge the sand first and the finer material second to improve the sediment properties for plant establishment.

18. The 30-cm hydraulic dredge pipe was to enter the site on the northwest, and the 60-cm effluent pipe to leave on the northeast. The effluent pipe was to pass horizontally through the dike with a 90-degree elbow and vertical riser pipe inside the containment area. No turbidity from the sandy dredged material was expected, but a ponded area at least 30 cm deep within a 1.5-m radius of the riser pipe was required during secondary channel dredging to allow settling. A dredging inspector

sampled effluent periodically and could control water quality by raising the riser pipe to increase ponding and settling.

#### Dike construction

19. The dredging and construction contract was awarded 3 January 1975. An access path for equipment was bulldozed from the west shore to the northwest corner of the site in mid-February. Tall vegetation in the line of the dike was flattened, and sand inside the area and adjacent to the dike line was pushed up by bulldozer to construct the dike (Figure 6). The dredging contractor built the dike; an inspector from the New England Division and an observer from the Waterways Experiment Station were present. Dike crest elevation was approximately 3.3 m with 33- to 45-degree slopes. Dike heights averaged just under 2 m above original ground along most of the dike alignment, but less than 1 m along the south border where natural elevation was near the required crest elevation.

#### Dredging and disposal

20. Navigation dredging began on 5 March 1975. It continued until 5 April with 9170 m<sup>3</sup> of sediments placed and most of the containment area covered (Figure 7). At that time, under agreement with the Connecticut Department of Environmental Protection, dredging was halted until July 1975 to prevent interference with the shad (Alosa spp.) run in the river. But in July, local boating interests requested that no dredging occur through October to prevent interference with boaters. It was agreed that dredging could continue on 1 November 1975, but the contractor could not return until December. Settled portions of the dike were raised, and navigation channel dredging began again on 8 December. It was completed 17 January 1976 with 5350 m<sup>3</sup> of additional material placed. Numerous delays because of equipment breakdown, cold weather, and river ice were responsible for the slow progress.

21. The contractor was required to grade the sand to a generally flat surface prior to placement of the finer-grained material. During disposal, the discharge pipe had been moved periodically to promote more uniform distribution of sand, and a bulldozer in the site had

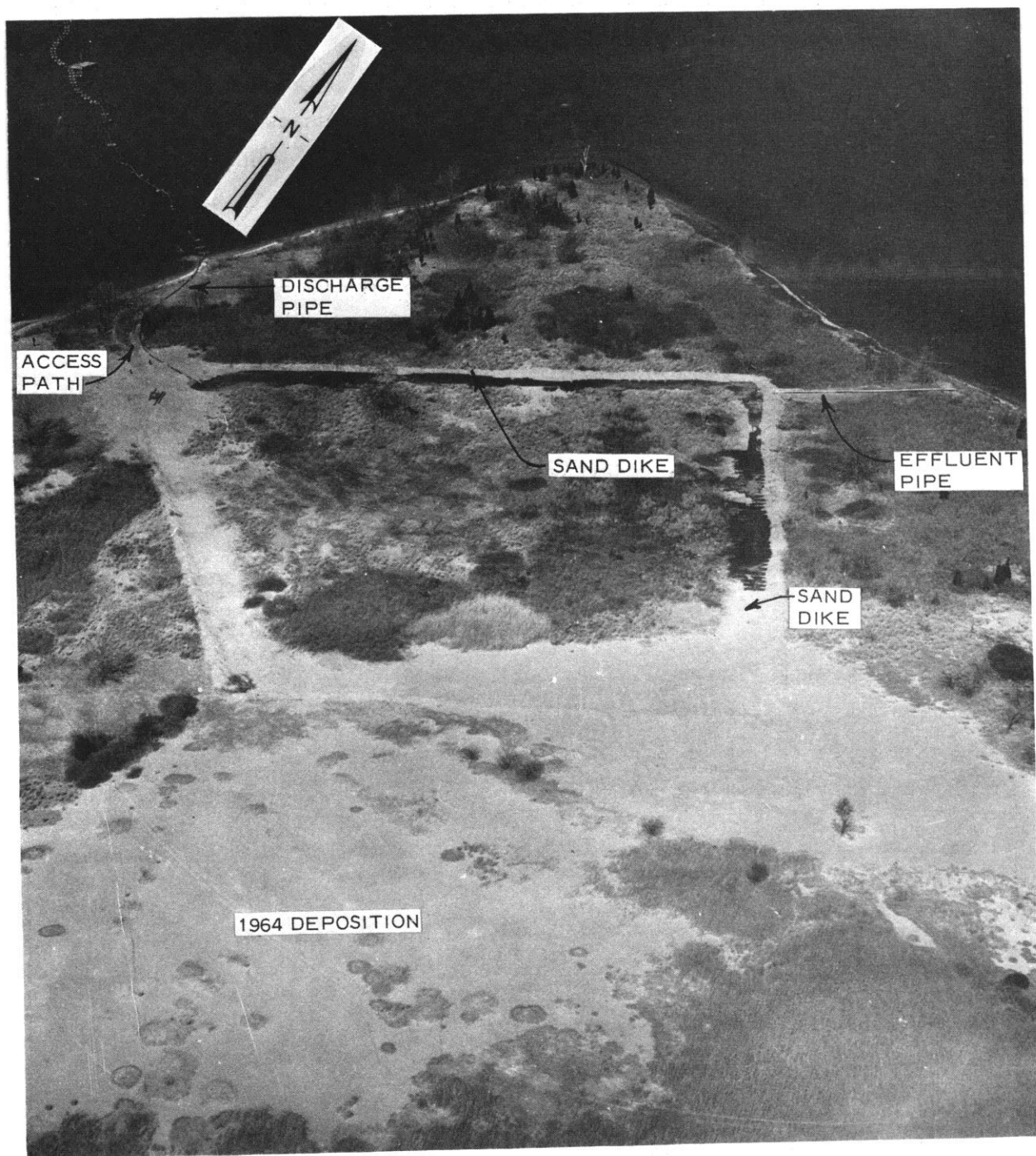


Figure 6. Aerial photograph of site in March 1975 showing placement of dike and pipes.



Figure 7. Aerial photograph of site in April 1975 showing sandy dredged material in place.



worked to spread the material as it was deposited. Between 21 and 28 January 1976, two bulldozers graded the site to an acceptable slope of less than half a meter, the slope being toward the effluent pipe.

22. Between 5 and 17 February 1976,  $9930 \text{ m}^3$  of fine-grained dredged material from the secondary channel were placed on top of the sand. These sediments tended to accumulate in a zone adjacent to the east dike where ponding and channelization occurred during disposal. Remnants of the channel and desiccation cracks were visible 3 months after dredging (Figure 8). Thickness of these sediments varied from 1 m in the southeast and northeast corners to less than 2.5 cm across most of the site.

#### Final grading

23. The sediments were allowed to dewater naturally, then during the period 30 August to 8 September 1976 a bulldozer was used to distribute the fine-grained material over the site to mix it with the sand. The retaining dike was also graded to blend in with the surface and surrounding area.

### Results and Discussion

24. A total of  $24,450 \text{ m}^3$  of material was placed in the containment area between March 1975 and March 1976. Winter weather conditions contributed to the slow progress. The finer-grained material took about 6 months to consolidate sufficiently to allow equipment movement. Even then, the southeast corner was too soft for a bog harrow.

25. Water seeped through the dike during disposal especially on the east and north, and settlement of up to 0.6 m occurred in the dike. Only minor maintenance was required, and the dike remained stable.

26. The dredging contract was awarded for \$127,020, which included all dredging, dike construction, and grading activities through February 1976. Cost of final grading in the fall of 1976 was \$1800 (100 hours of machine and operator).

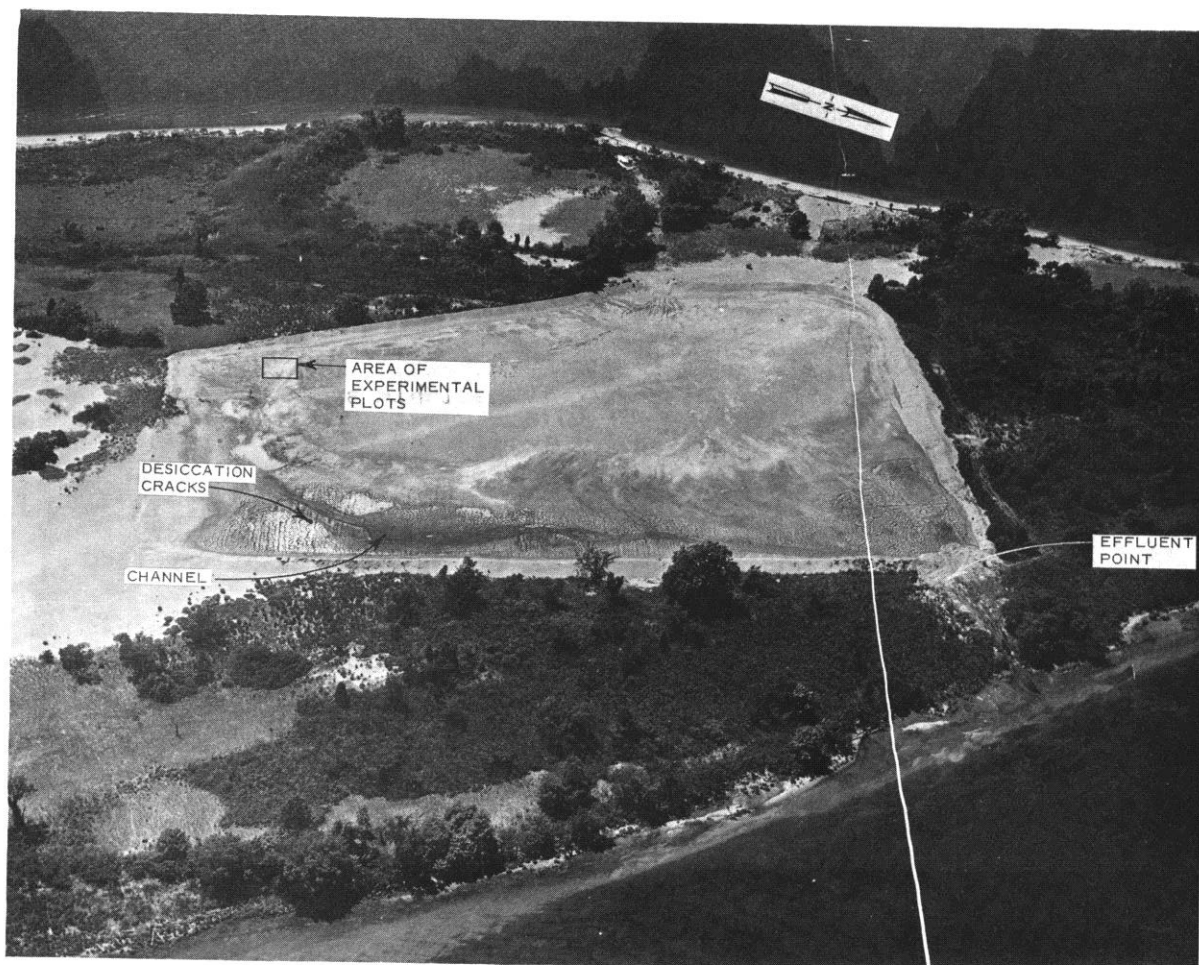


Figure 8. Aerial photograph of site in May 1976 showing fine-grained material in place.

## PART IV: SOILS AND BOTANY

### Methods

#### Design

27. About 45 kg of sediments taken from the secondary channel in March 1975 were analyzed for acidity, calcium, magnesium, potassium, phosphorus, organic matter, and nitrate and ammonium nitrogen at the Agronomy Department of the University of Connecticut. A series of samples of the dredged material on site was taken in March 1975 and February to late June 1976 and analyzed at The Connecticut Agricultural Experiment Station, New Haven, for soil texture, pH, nitrate and ammonium nitrogen, phosphorous, potassium, and soluble salts. These tests were to determine the potential adverse effect of soil salinity and sulfide oxidation (acidity) on plant establishment and growth. Changes in soil pH following alternate wetting and drying cycles were determined for a limited number of samples.

28. Sediments taken to the University of Connecticut were used in greenhouse studies as well. Ten plant species were grown to assess the need for lime and fertilizer applications (Washko 1977). The decision on which species to plant on the site was made as a result of these tests and coordination among personnel of the University, Department of Environmental Protection, U. S. Fish and Wildlife Service, and Waterways Experiment Station.

29. Species selected, seeding rates, lime application rates, and site design are shown in Figure 9. Fertilizer (10-20-10) was applied at the rate of 560.6 kg/ha. Standard measurements are given in Barry et al. (1978) for convenience of the reader.

#### Site preparation and planting

30. The area selected for the experimental plots was in the extreme southwest corner, that portion of the site with the most uniform texture. It was rototilled, fertilized, limed, and seeded on 16-17 August 1976 by Youth Conservation Corps members under supervision of the Department of Environmental Protection. After the two sediment types were

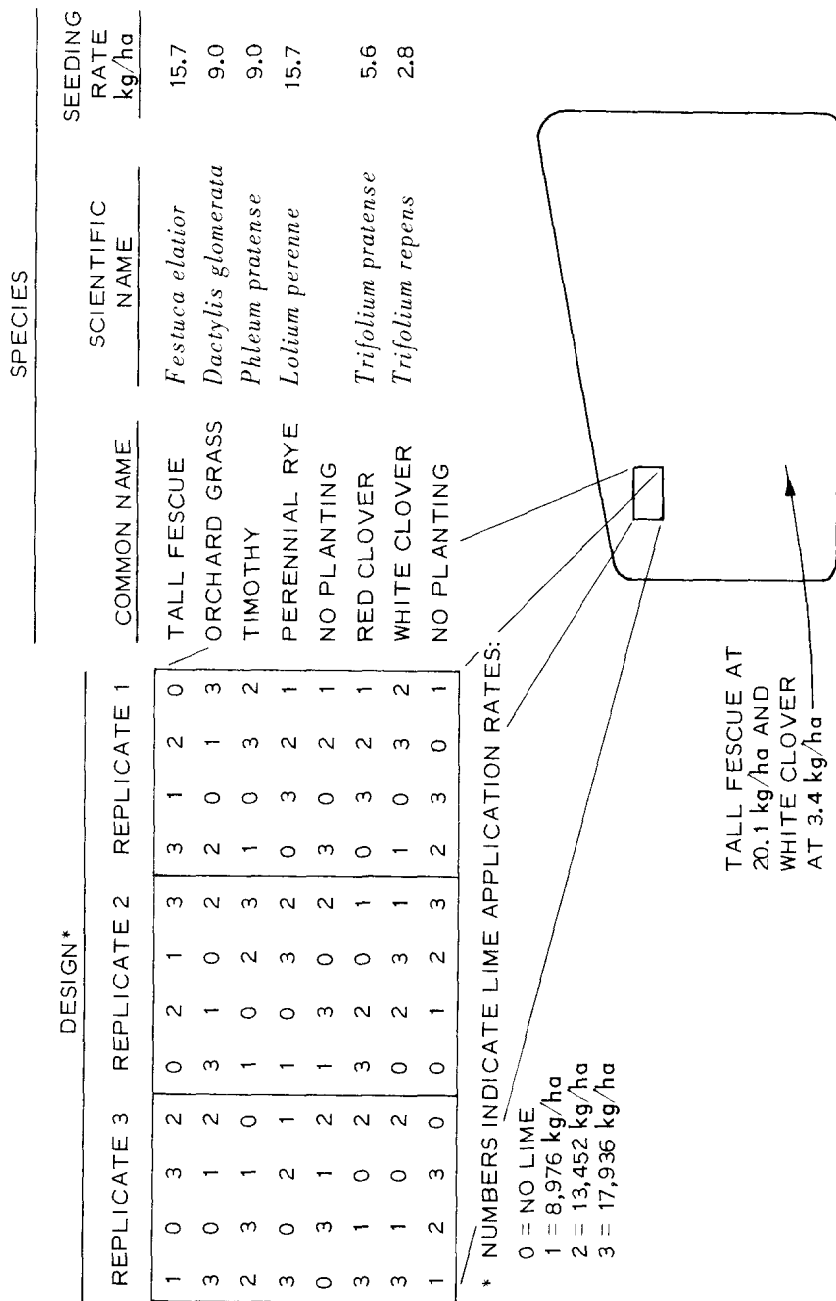


Figure 9. Species selected, seeding and lime application rates, and site design for experimental plots.

mixed over the remainder of the site, and between 9 and 16 September, half of the lime was applied, the site harrowed, the remainder of the lime applied, fertilizer spread, the site harrowed again, and then seeded and brushed.

### Monitoring

31. Estimates of percent cover and average plant height were made on the experimental plots on 1 October 1976. On 14 June, 11 July, and 8 August 1977, measurements of natural invasion, stem density, phenology, plant height, cover, and miscellaneous environmental effects were made in the plots and on the remainder of the site. Seed production and biomass were measured in mid-July and the end of August, respectively. Details of botanical sampling are given in Barry et al. (1978).

32. Soil samples from replicates 1 and 3 of the experimental plots and from four locations on the remainder of the site were taken in September 1977. They were analyzed at The Connecticut Agricultural Experiment Station for pH, soluble salts, nitrogen, potassium, and phosphorus.

## Results and Discussion

33. Sediments from the secondary channel were suspected to contain significant levels of sulfides, which, upon being placed on an upland site and dried, would be oxidized to sulfates (Ponnamperuma 1972), increasing soil acidity. Greenhouse tests (Washko 1977) showed that both grasses and legumes required liming to survive. Although the equivalent of 8976 kg/ha of lime improved growth more than 4488 kg/ha, normal growth still did not occur. Liming increased the soil pH from 3.6 to 4.2. Addition of fertilizer appeared to benefit the grasses but not necessarily the legumes.

34. Soil samples taken from the disposal area after dredging and during the months of dewatering showed that soil pH continued to drop to approximately 4.0 after three to five wetting and drying cycles. Also, as the sediments on site dewatered over the spring of 1976, salinity increased to levels that could restrict growth of salt-sensitive plants.

35. The percent cover attained by the plants in the experimental plots reveals the effect of soil treatment on their growth (Figure 10). As of October 1976, only orchard grass, perennial rye, and tall fescue had achieved more than 20 percent cover. During the 1977 growing season, the four grasses greatly increased coverage of their respective plots, while the two clovers decreased. Fescue and clover on the remainder of the site showed the same relationship.

36. The legumes may have been unsuccessful for a number of reasons including effects of high soil salinity, high acidity, low levels of potassium, and lack of Rhizobium. Figure 11 shows that the electrical conductivity of the unplanted row and the rows planted to clovers approached 2.0, the point at which salts may begin to restrict growth of these clovers (Richards 1954). Some leaching occurred during the 13 months between plot establishment and soil sampling, so salinity was probably even higher at the time of seeding.

37. A second probable cause of poor legume performance was high soil acidity. Liming with 8976 kg/ha only increased soil pH from 4.0 to 4.25 (Figure 12). Addition of either of the two higher lime levels increased the pH to 4.5. These soil pH levels are far below the optimum (6.0 to 7.0) for normal growth of most legumes (Wolfe and Kipps 1959).

38. A third factor that may have limited growth of the clovers was the level of available potassium as revealed by the September soil samples. Legumes require high levels of potassium (Thompson 1963), and all plots were very low in that element.

39. Another possible factor in the legume ground cover decrease in 1977 was failure to inoculate the seed with nitrogen-fixing bacteria (Rhizobium). No nodules were found on the roots during biomass sampling, indicating that the nitrogen-fixing process did not establish. It is doubtful if Rhizobium would have been able to function at ambient pH levels, however (Alexander 1961).

40. Liming had a beneficial effect on both clovers and grasses (Figure 13). Addition of lime initially increased percent cover for the clovers from 5 percent to approximately 20 percent by October 1976; however, the clover declined in all plots regardless of lime levels.

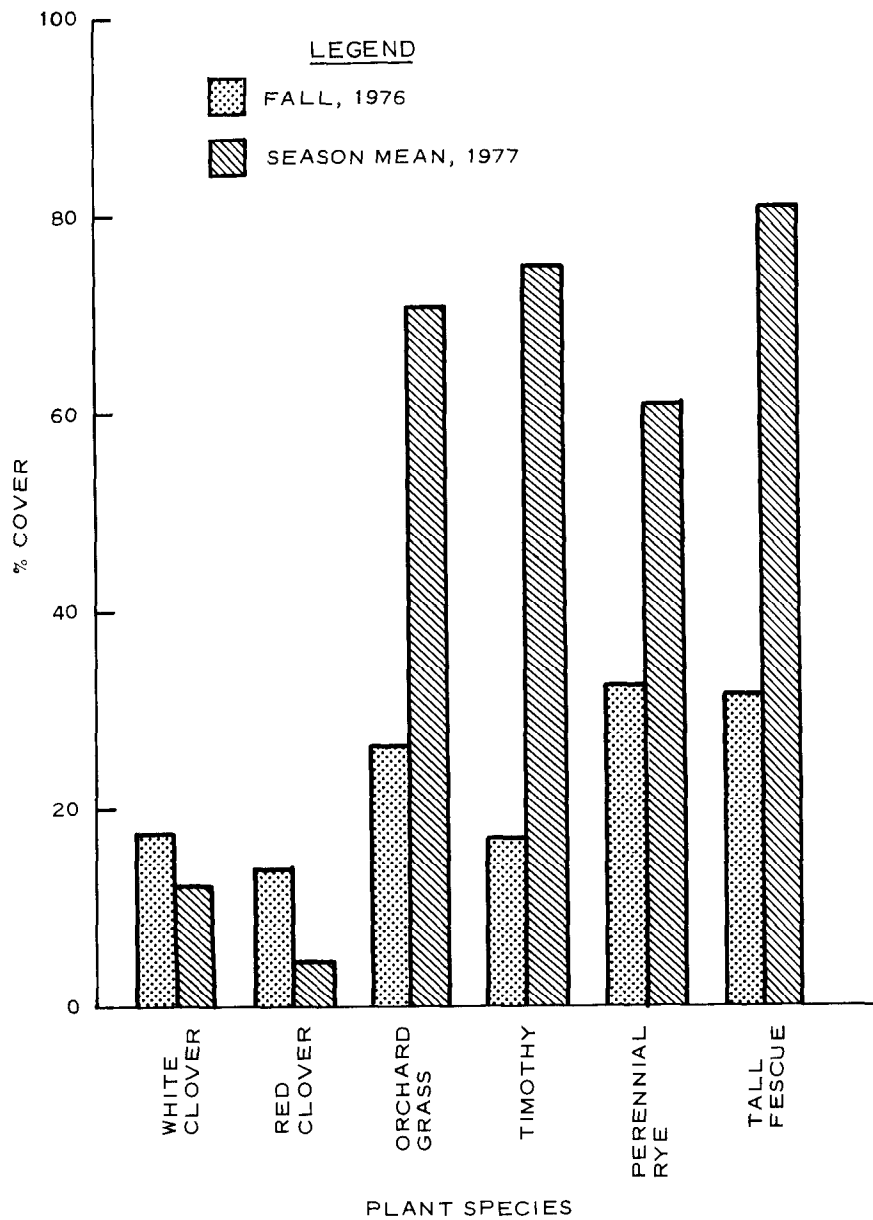


Figure 10. Percent cover of plant species in the experimental plots.

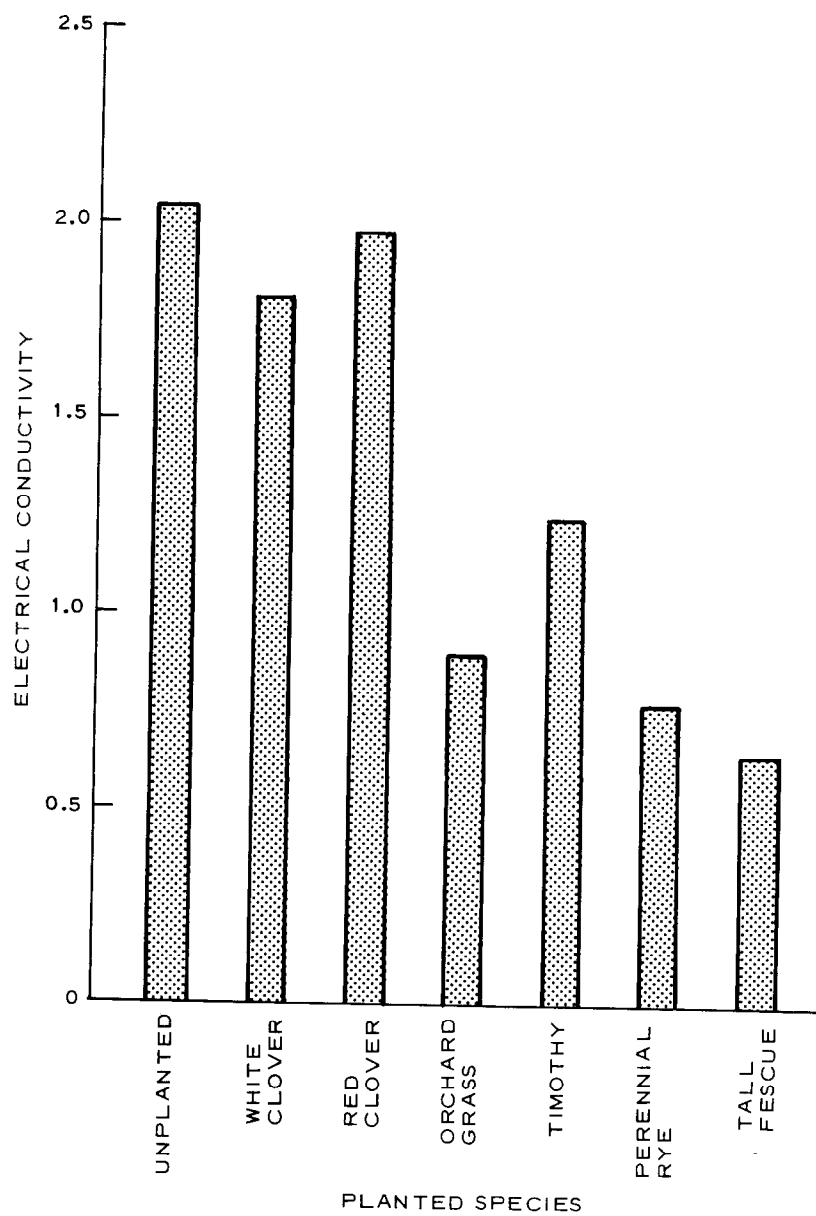


Figure 11. Electrical conductivity of the soil by plant species in the experimental plots.



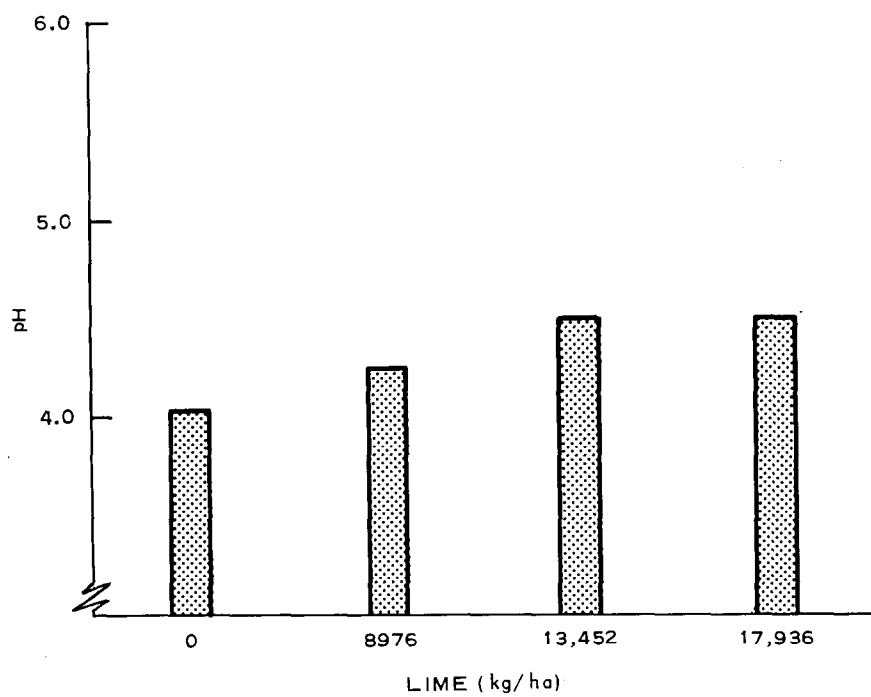


Figure 12. Effect of lime application on pH values in experimental plots.

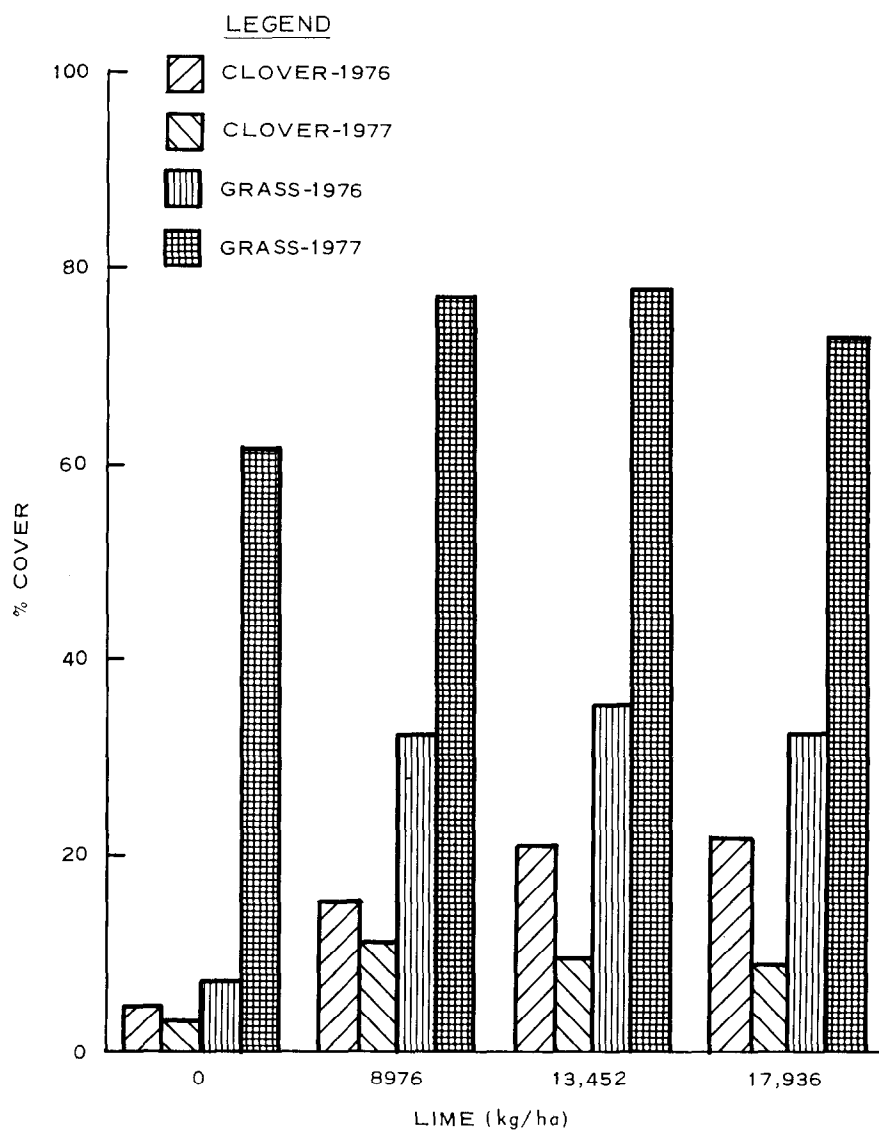


Figure 13. Effect of lime application on percent cover of clovers and grasses.

Grasses in limed plots showed over four times the cover of those in unlimed plots in October 1976. Differences among the responses to the three lime levels were not significant. Rate of liming also caused an increase in percent cover of grasses for the 1977 season with the low level of lime boosting mean percent cover from 62 to 77 percent.

41. It is not surprising that the grasses performed better than the legumes in these studies, since the grasses planted were more tolerant of high soil salinity and acidity. As indicated by Ryan et al. (1975), most grass and legume species will germinate if soil pH can be raised above 4.0. However, most legumes require the soil pH to be above 5.5 in order to approach normal growth.

42. As expected, invading plant species established best in those plots where there was the least competition from planted species (Figures 10 and 14). The most abundant invader was fall panic grass (Panicum dichotomiflorum), a common and adaptable species that does well on bare and slightly xeric soils. Figure 15 shows plant coverage of the site in September 1977. Additional results of the plantings are discussed in Barry et al. (1978).

43. In March 1978, tall fescue was the major species on the majority of the site, covering it well (written communication, Dr. Walter Washko, Department of Agronomy, University of Connecticut, Storrs). Timothy appeared to be confined to those areas with the greatest proportion of fine particles.

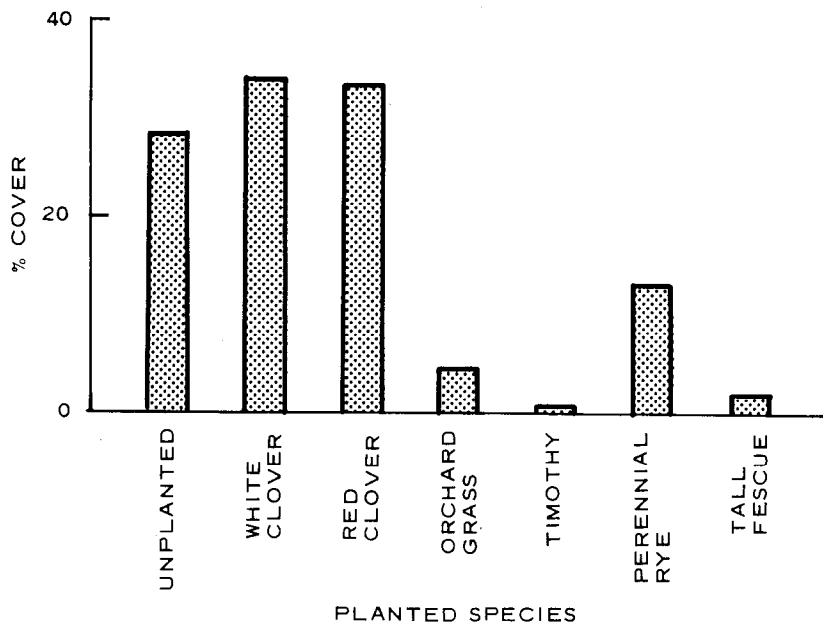


Figure 14. Percent cover of species invading the experimental plots.



Figure 15. Aerial photograph of site in September 1977

## PART V: WILDLIFE

### Methods

44. Accompanying the baseline survey of vegetation on Nott Island were periods of observation for mammals, birds, amphibians, and reptiles. Mammals were recorded through trapping grids, direct sightings, or observation of sign; birds through breeding bird surveys; and amphibians and reptiles through direct sightings or observation of sign. Details of these methods for 1974 are given in Coastal Zone Resources Corporation (1977) and for 1975 to 1976 in Warren and Niering (1978) and Warren et al. (1978).

45. In 1977, small mammals were sampled within 1-ha grids in and around the habitat development site. Vegetation within a 1-m radius of each trap was sampled to classify each trap location for habitat preference. Bird species composition, density, and diversity were determined through censuses on transects, observation stations, and diurnal surveys. Breeding bird surveys and nest searches were also conducted. Other animal sightings and sign were recorded when observed. Barry et al. (1978) gives additional detail on methodologies.

### Results and Discussion

#### Mammals

46. The first mammal use of the containment area itself was by white-tailed deer, whose tracks were seen in summer 1975. Moles tunneled in the sandy dredged material. Rodent use was not documented until July 1977 when 10 meadow voles were trapped, although they probably invaded the site in spring when vegetation emerged. In August, 15 more voles and 4 meadow jumping mice were trapped. Considerable numbers of deer pellets were noted in March 1978 (written communication, W. Washko).

47. Species composition of mammals on Nott Island has remained relatively constant throughout the study, although numbers present

have changed. There have been captures of five species and other records of four more, as shown in the following tabulation:

Species	Period of Observation				
	Fall 1974	Winter/ spring 1975	Summer 1975	Summer 1976	Summer 1977
Short-tailed shrew* <u>Blarina brevicauda</u>	X	X		X	X
Eastern mole <u>Scalopus aquaticus</u>	X		X	X	X
White-footed mouse* <u>Peromyscus leucopus</u>	X	X			
Meadow vole* <u>Microtus pennsylvanicus</u>	X	X	X	X	X
Muskrat <u>Ondatra zibethicus</u>	X	X	X	X	X
Norway rat* <u>Rattus norvegicus</u>			X		
Meadow jumping mouse* <u>Zapus hudsonius</u>	X		X	X	X
Raccoon <u>Procyon lotor</u>	X	X	X		X
White-tailed deer <u>Odocoileus virginiana</u>	X	X	X	X	X

\* = Captured species.

48. The dominant small mammal throughout the study was the meadow vole, found in highest numbers and a wider variety of habitats than expected, since it is usually considered a grass-herb species. Meadow jumping mice were second in dominance, often overlapping with voles in habitat preference. The two species showed an inverse relationship in density for a given habitat, a relationship due either to habitat orientation or to competition (Shure 1970). The white-footed mouse was not recorded after spring 1975, either due to an impact of disposal and habitat modification or to a naturally unstable or low population. Presence of the Norway rat was apparently related to operational activities in 1975, during which time rats were present but did not establish. See Coastal Zone Resources Corporation (1977), Warren and Niering (1978), Warren et al. (1978), and Barry et al. (1978) for additional discussion of mammal occurrences.

49. Species composition on Nott Island is probably very similar to that on the mainland (personal communication, Dr. Bill Barry, Department of Zoology, Connecticut College, New London). A brief small-mammal trapping session in 1977 in the Lord's Cove area yielded (in order of abundance) meadow voles, white-footed mice, short-tailed shrews, and meadow jumping mice. The meadow voles were more restricted in their habitat preference than on Nott Island, and white-footed and meadow jumping mice were reversed in abundance (personal communication, B. Barry). Since meadow voles on Nott Island were using habitat normally occupied by white-footed mice on the mainland, an inhibiting influence of meadow voles on white-footed mice is implied. The distance between the mainland and the island is within the swimming ability of white-footed mice, so isolation should not be the reason for lack of mice on Nott Island.

#### Birds

50. Some effect of habitat development on bird use of the island during 1977 was evident. A pair of killdeer (Charadrius vociferous) nested successfully on the site. Insectivores, including four species of swallow, and seed-eaters, especially song sparrows (Melospiza medodia) and mourning doves (Zenaida macroura), fed on the area. Canada geese (Branta canadensis) grazed on orchard grass and perennial rye in the experimental plots and on timothy on the remainder of the site in March through June. Heavy grazing by geese was evident in March 1978 (written communication, W. Washko).

51. On Nott Island in general, there was an increase in bird use from June to July and a decrease in August with migration. Densities and diversities were highest along transects with greater vegetative cover, as predicted by MacArthur and MacArthur (1961) for temperate situations. Bird densities and number of species were lower on the two transects on the site than on any other transects, although diversity was comparable. The influence of surrounding habitat was evident: the transect adjacent to greater vegetative cover on the northeast showed consistently higher measures of density, species numbers, and diversity than the transect adjacent to the more sparsely vegetated areas.



52. With the exception of the habitat development site itself and the sparsely vegetated or bare disposal sites, nesting territories covered the island. Although the numbers of pairs and species varied, three seasons of data showed the same species to be the most common nesters: red-winged blackbird (Agelaius phoeniceus), song sparrow, long-billed marsh wren (Cistothorus palustris), yellow warbler (Dendroica petechia), and common yellowthroat (Geothlypis trichas). Densities of breeding pairs were higher in the marsh than in the upland in 1975 and 1976 but lower in the marsh in 1977. However, two to four times as many species nested in the upland as in the marsh. Warren et al. (1978) and Barry et al. (1978) give a more detailed discussion of avian data.

53. Nine of the 85 species recorded on Nott Island are considered rare, endangered, or members of a declining population in Connecticut (Dowhan and Craig 1976). There was no evidence of either a positive or negative effect on any of the nine species from habitat development activities at the site.

#### Amphibians and reptiles

54. Occurrence of three amphibian and six reptile species was recorded during the study. A low number of sightings implied low population levels on the island.

## PART VI: CONCLUSIONS AND RECOMMENDATIONS

55. Dredging and disposal operations at Nott Island were typical of maintenance projects in that area, with the exception that dredging is usually not scheduled for the winter season when weather conditions are likely to hinder the work. The need to treat the newly-deposited sediments and establish vegetation on a research schedule necessitated off-season dredging.

56. The dredged material at this site made a rather harsh environment for establishment of some domestic plant species not generally adapted to these conditions. Soil salinity was sufficiently high to restrict growth of salt-sensitive species. Soil acidity resulting from oxidation of the sulfides was a problem with the fine-grained sediments; apparently large quantities of lime would be required to neutralize this acidity. The four grasses (orchard grass, timothy, perennial rye, and tall fescue) were quite successful and achieved about 80 percent cover of the plots during 1977 when limed at 8976 kg/ha. Red and white clover were not successful. High soil salinity, low soil pH, low soil potassium, and insufficient Rhizobium inoculum were factors contributing to this failure. Testing other legumes such as sericea (Lespedeza cuneata) or Alsike clover (Trifolium hybridum) that are more tolerant of acid soils would be worthwhile.

57. Wildlife response to vegetation establishment was evident primarily through feeding activity. Future use of the site will depend on as yet undetermined management practices applied to the vegetation.

58. Recommendations resulting from work at this site, which may apply to similar projects, include:

- a. If the possibility of an adverse soil condition exists, have soil samples analyzed for that condition as soon as possible so corrective action can be taken.
- b. If acidity is high, add molybdenum and inoculate with Rhizobium to aid nodule formation and nitrogen fixation in legumes.
- c. Apply lime in two portions, the first at least 4 months prior to planting vegetation.

- d. Analyze sediments for potassium if legumes are to be planted, and supplement if levels are too low.
- e. If salinity is high, either allow time for leaching, accept invading species, or select salt-tolerant species for planting.

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In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Hunt, L            Jean

Habitat development field investigations, Nott Island upland habitat development site, Connecticut River, Connecticut; summary report / by L. Jean Hunt, B. R. Wells, and Alfred W. Ford. Vicksburg, Miss. : U. S. Waterways Experiment Station ; Springfield, Va. : available from National Technical Information Service, 1978.

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Appendices A and B on microfiche in pocket.

Literature cited: p. 38-39.

1. Connecticut River. 2. Dredged material. 3. Dredged material disposal. 4. Field investigations. 5. Habitat development. 6. Habitats. 7. Nott Island, Conn. 8. Vegetation establishment. 9. Waste disposal sites. 10. Wildlife

(Continued on next card)

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Habitat development field investigations, Nott Island upland habitat development site, Connecticut River, Connecticut; summary report ... 1978. (Card 2)

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